



# CONCEPTUAL MODEL OF PERCEPTUAL INFORMATION ARCHITECTURE CROSS MEDIA: COMMUNICATION BASED ON COGNITIVE SYSTEMS PATTERN

Dr. Mainak Ghosh

Assistant Professor, Department of Architecture & Regional Planning, Indian Institute of Technology Kharagpur, India –721302.

## ABSTRACT

The overwhelming abundance of information need to follow a structure for its meaningful organization and hence perception and cognition and recognition by human beings for various utilization as the case may be. However a holistic approach towards information architecture cross media following systems approach is absent. Hence this paper aims at fulfilling this gap by evolving a conceptual model for information architecture. The conceptual model has been visualized as a fundamental for information structuring, processing, representation, and dissemination irrespective of the medium and its variations. It also adapts the systems approach towards information and defines a dimensional structural system for the same. In order to justify the work ability of the model an information and knowledge dissemination model has been designed using computer based interactive education medium.

### The Anecdote

"All communication involves the creation, transmission, and reception of information." Lidwell et al. 2003.

Every living organism receives information in some form or the other from its surrounding elements, be living or non-living. The information is processed and triggers various activities within the organism. Information and communication today has become an integral and essential part of our lives. Its predominance dates back in the time when man has dealt with information to understand, communicate, enrich knowledge and represent. The paintings made on the walls of caves representing something, producing a particular sound indicating danger or selecting the right stone for an arrow head, by touching and feeling – all had been various modes of transaction of information. Over the course of time, the complexity in the world of information has enormously increased, more so by the prolific use of advanced and highly diverse communication channels. Over the history of mankind, grain by grain, information pool have enormously grown. A mammoth volume with no specific unit of measurement as such, has enormous ways of being used, communicated, shared and materialized. Information and communication technology has made information abundant: thanks to the Internet you can basically get any information you might desire in seconds. During most of history, information was a scarce resource that was of the greatest value to the small elite that had access to it (Shenk 1997). Enormous effort would be spent in copying and transferring the little data available, with armies of monks toiling years in the copying by hand of the few available books, and armies of couriers relaying messages from one part of the kingdom to another. Nowadays, it rather seems that we get much more information than we desire, as we are inundated by an ever growing amount of email messages, internal reports, faxes, phone calls, newspapers, magazine articles, WebPages, TV broadcasts, and radio programs. Part of the problem is that ephemeralization has made the retrieval, production and distribution of information infinitely easier than in earlier periods, practically eliminating the cost of publication. This has reduced the natural selection processes which would otherwise have kept all but the most important information from being transmitted (Heylighen 2002). We encounter information, process it and represent it but the entire course has become far more intricate because of lack of coherence in the domain of information. The increased amount of information and diversities of media adds on to the problem. It is a world of information that we live in, however little has been done towards formulating a generic methodology to organize or represent information systematically and efficiently (Tononi, Edelman & Sporns 1998). That is the reason perhaps why still we do not really have an unit of measurement of information, not in terms of data storage point of view, but real value for information as such. Moreover there is a dearth of universal pattern to justify of caves representing something, producing a particular sound indicating danger or selecting the right stone for an arrow head, by touching and feeling – all had been various modes of transaction of information. Over the course of time, the complexity in the world of information has enormously increased, more so by the prolific use of advanced and highly diverse communication channels. Over the history of mankind, grain by grain, information pool have enormously grown. A mammoth volume with no specific unit of measurement as such, has enormous ways of being used, communicated, shared and materialized. Information and communication technology has made information abundant: thanks to the Internet you can basically get any information you might desire in seconds. During most of history, information was a scarce resource that was of the greatest value to the small elite that had access to it (Shenk 1997). Enormous effort would be spent in copying and transferring the little data available, with armies of monks toiling years in the copying by hand of the few available books, and armies of couriers relaying messages from one part of the kingdom to another. Nowadays, it rather seems that we get

much more information than we desire, as we are inundated by an ever growing amount of email messages, internal reports, faxes, phone calls, newspapers, magazine articles, WebPages, TV broadcasts, and radio programs. Part of the problem is that ephemeralization has made the retrieval, production and distribution of information infinitely easier than in earlier periods, practically eliminating the cost of publication. This has reduced the natural selection processes which would otherwise have kept all but the most important information from being transmitted (Heylighen 2002). We encounter information, process it and represent it but the entire course has become far more intricate because of lack of coherence in the domain of information. The increased amount of information and diversities of media adds on to the problem. It is a world of information that we live in, however little has been done towards formulating a generic methodology to organize or represent information systematically and efficiently (Tononi, Edelman & Sporns 1998). That is the reason perhaps why still we do not really have an unit of measurement of information, not in terms of data storage point of view, but real value for information as such. Moreover there is a dearth of universal pattern to justify information organization, its flow and human perception towards it (Heylighen & Bernheim 2000, Nye et al. 1997).

The objective of the paper is to put forward a conceptual model of information architecture, which is visualized to serve structuring any information irrespective of the media and other variations. The model is hypothesized to define any information through this structure to be part of the whole universal information space. Any information is part of a bigger whole and then any information is formed by smaller parts. The model explains the architecture through systems approach where the core information is considered as a system itself. And as every system, comprises of its immediate super-system and sub-system, so does the information architecture. The model helps to easily identify patterns of overlap and inter-relation amongst different information. Hence the proposed model can be useful tool to structure information for any usage. It can find its efficient application over a wide range of disciplines dealing with information, communication, knowledge management and design etc. the generic model is aimed to suit information structuring of financial devices of a bank to that of video-games alike.

The workability of the hypothesis has been exemplified by creation of an information and knowledge dissemination exercise. A module for computer based interactive educational medium has been executed using the proposed information architecture.

### The Approach

Today technological advancement has brought forth huge collection of multimedia content suitable for various purposes. The development and implementation has also gathered considerable momentum. Hence creation of versatile and attractive information-communication content does not pose any challenge anymore, but the fruitful representation and structuring does. The information architecture and its communication is based on systems approach. Systems approach involves placing as much emphasis on identifying and describing the objects and events themselves. Systems are patterns of cause and effect relationships. These can be simple and unidirectional or they may be linked together in long chains. Any one factor can exert a control function (causing a change in another) and a dependant function (being changed by another) The concept of system is prevalent phenomenon applicable in wide range of disciplines such as ecology, biology, physics, and logic and so on. The Greek word *synistanai* is the predecessor of the term "systems" which means "to bring together or combine". Over the centuries the term and concept has been used. For millennia Armies and governments have been managed using the components of the organizational concepts

referred to as the “systems approach”.

However, it was not until the Industrial Revolution of the 19<sup>th</sup> and 20<sup>th</sup> centuries that formal recognition of the “systems” approach to management, philosophy, and science emerged. As the level of precision and efficiency demanded of technology, science, and management increased the complexity of industrial processes, it became increasingly necessary to develop the conceptual basis to avoid being overwhelmed by complexity (Clayton & Radcliffe 1996). Hence the ever increasing domain of Information and communication and its complexity, has been perceived in similar concept anchored to systems approach.

The systems approach emerged as scientists and philosophers identified common themes in the approach to managing or organizing complex systems. Four major concepts underlie the systems approach:

**Specialization:** A system is divided into smaller components allowing more specialized concentration on each component.

**Grouping:** To avoid generating greater complexity with increasing specialization, it becomes necessary to group related disciplines or subdisciplines.

**Co-ordination:** As the components and sub-components of a system are grouped, it is necessary to co-ordinate the interaction among groups. Emergent Properties: Dividing a system into sub-systems (groups of component parts within the system), requires recognizing and understanding the “emergent properties” of a system; that is, recognizing why the system as a whole is greater than sum of its parts.

The systems approach considers two basic components: Elements and Processes. Elements are measurable things that can be linked together. They are also called objects, events, patterns, or structures. Processes change elements from one form to another. They may also be called activities, relations, or functions. In a system the elements or processes are grouped in order to reduce the complexity of the system for conceptual or applied purposes. Depending on the system's design, groups and the interfaces between groups can be either elements or processes (Clayton & Radcliffe 1996).

The two basic components have been correlated for information architecture and communication, where the elements are the information packages while the processes are the links, activities, relations, or functions. The systems approach also has been considered with the view of four underlying concepts of the same, namely: Specialization, Grouping, Co-ordination and Emergent Properties. All of the four concepts has strong relationship so far information and communication paradigm is concerned.

The framework also strongly draws its inspiration from systems theory. Systems theory was proposed in the 1940's by the biologist Ludwig von Bertalanffy (General Systems Theory, 1968), and furthered by Ross Ashby (Introduction to Cybernetics, 1956). Von Bertalanffy was both reacting against reductionism and attempting to revive the unity of science. He emphasized that real systems are open to, and interact with, their environments, and that they can acquire qualitatively new properties through emergence, resulting in continual evolution. Systems theory focuses on the arrangement of and relation between the parts which connect them into a whole. Thus the same concepts and principles of organization underlie the different disciplines (physics, biology, technology, sociology, etc.), providing a basis for their unification. Systems concept include system-environment boundary, input, output, process, state, hierarchy, goal directedness, and information.

The development of systems theory are diverse (Klir 1991), including conceptual foundations and philosophy (e.g. the philosophies of Bunge 1977a, b, Bahm 1981 and Laszlo 1972); mathematical modeling and information theory (e.g. work of Mesarovic and Klir 1991); and practical applications (Mbarika, Shankar & Raju 2003). The conceptual model follows organization of information apparently independent, but the processes drawing links between them. The design based on various need and interactivity would shape the process, and which in turn would lead to the organization of information and its communication.

### The Architecture

The proposed architecture considers a pack of information as system. The different packs of information pertaining to different topics are equivalent to the elements. These elements follow the hierarchy of super-system, system and subsystem.

The relationship amongst different elements is established through various processes or links. The processes could be interaction between user and environment, user to user, communication modes, transmission, design, absorptions, perception etc. Every process initiates with a core area of interest or in other words the point from where it all begins. The core informational topic under consideration could be treated as system. However every system is part of a super-system. The information architecture should imbibe the aspect of supersystem to be linked with the system. It forms the back bone of the system which could be easily referred to and contextualized. The system might be viewed as a continuum from the super-system, in other words the system evolves from supersystem.

Here the concept of 'grouping' plays an important part. On the other end sub-system could be defined as the micro-aspects of a system. In information hierarchy all the relevant information packages which serve as elementary components supporting the system, bringing forth the concept of 'emergent properties' of the system.

Apart from standard notion of Systems approach, based on the aspect of 'specialization', the concept of Keynode has been proposed. Keynodes are information packages which neither form part of super-system nor sub-system. The key-nodes are meant to be systems independent of their own owing to their specialization and attributes, yet connected to the core system, or topic under consideration. Key-nodes are relatively disconnected piece of information in relation to the core system under consideration, however it plays an important role so far as generic information architecture is concerned. As it provides room for so called unrelated information packages, yet connected to the system in some fashion, building up into a seamless information space. To consider an example, when talking about 'football', the various package of information associated with football works as system, its super-system may house information about, soccer field, players, world cup, clubs, countries, its history etc. while the sub-system takes care of its dimension, materials, sizes, color etc. Based on the process or communication requirement the associated information packages are utilized, either system, sub-system or super-system. However the architecture remains incomplete until the key-nodes (links to other apparently unrelated systems) are established, for example football to me makes me recall my aunt, while football to my friend makes him think of the number 23. These packages of information based on a particular process of communication or interaction with the user may look beyond systems approach, however these are existent pieces of information, contextually relevant, and which are again systems in themselves. Hence keynodes provide essential routes how information hopping is done based on various processes that are triggered. The conceptual architecture hence creates a generic model embracing a global information space consisting of systems, its supersystem, sub-system and key-nodes. Again due to communication needs or other processes, the system shifts in terms of topic or package of information along with its own paraphernalia in the same global information space which remains constant.

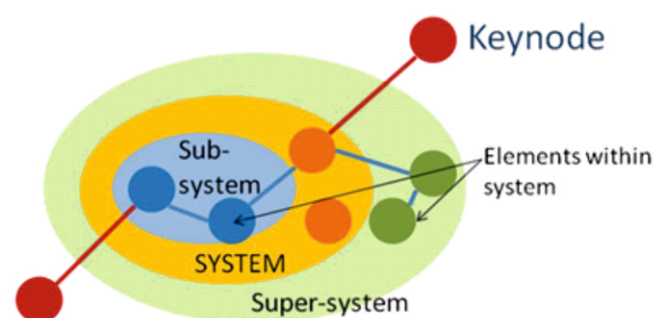


Fig. 1: Generic Information Architecture using Systems Approach: The proposed architectural methodology

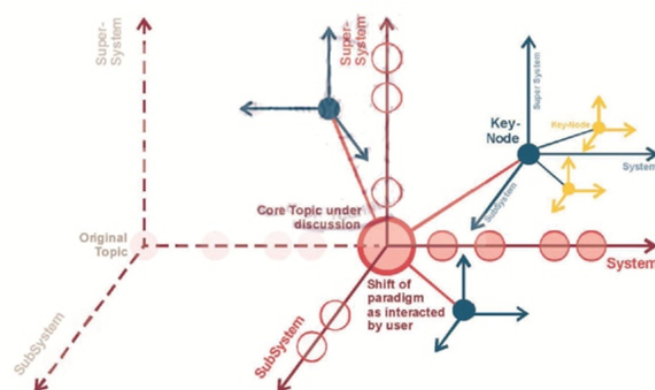


Fig 2: Change of System in Information Space

### The Application

The hypothetical model of information architecture has been implemented on a working model of information dissemination e-learning platform. Like no other training form, e-learning promises to provide a single experience that accommodates the three distinct learning styles of auditory learners, visual learners, and kinesthetic learners. Other unique opportunities created by the advent and development of e-learning are more efficient training of globally dispersed audience; and reduced publishing and distribution costs as Web-based training becomes a standard (Kruse 2004). The proposed model revolves around creating a computer based interactive medium focusing on information and its communication,

on how a sewing machine works. The system contains information packages which talk about core functioning of sewing machine. The medium aptly has room for the learner to learn about super-system, such as History of sewing machine, mechanical engineering, types of sewing machines, appliances, – electronic or mechanical, fashion design, textile, tailor etc. Mechanism of sewing invariably brings with it the sub-system information packages, about the needle, threads, levers and gears, bobbin, pulley etc. The keynode association has been carefully brainstormed and surveyed. Ideally the keynode connectivity with a particular system is infinite, one can relate to almost anything or everything. However certain frequently incurred keynodes could be bundled. For the case of how sewing machine works, the key-node association has been linked with topics of weather, rain, motion, circle, momentum, plants, animal etc. The e-learning platform cut across multi-media communication for dispersion of these information in form of audio-visual, text, animation and kinesthetics (clicking, typing etc.). Based on survey findings of 50 students of Indian Institute of Technology Kanpur, 96% and 88% strongly affirmed the importance of super-system and sub-system respectively in the e-learning module designed based on the conceptual information architecture. 94% believed that the incorporation of key-node would be effective and beneficial in terms of information communication for the learning module.

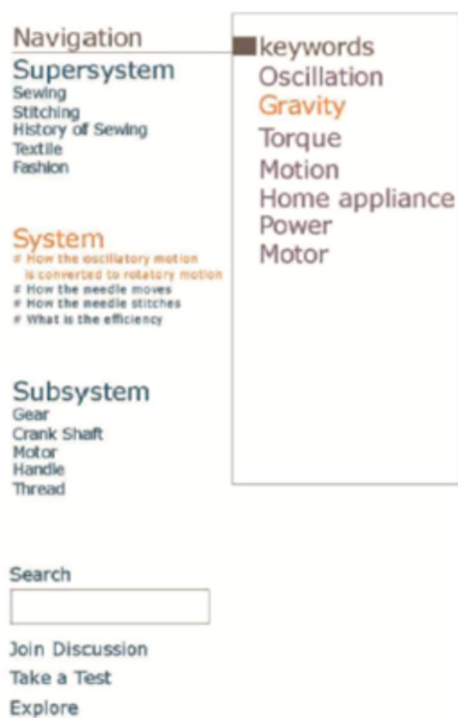


Fig. 3: Information Architecture of the e-Learning Module: A particular case example using the methodology discussed earlier



Fig. 4: Designed Interface of the e-Learning Module: Based on the information architecture imbuing multiple media

#### The Analog: Conclusion

Formation of generic information architecture which suits information processing, representation and communication have been hypothecated by the conjunction of systems approach. Information is scattered everywhere, visual, auditory, textual and in other media formats. However a common architecture irrespective of the media and physical form, exists, which deals with a conceptual system underlying the skin. To put it in other words, the e-learning module developed

finally had a juxtaposition of video, audio, text, animations etc. which also calls in human interaction of clicking, pausing, typing texts etc. A pure form of multimedia, rests on an effective backbone of the conceptual information architecture. Where the information packages and its communication processes have been organized based on the evolved systems approach. Information structuring and its communication can strongly bank on the proposed information architecture cross media.

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